

The knight of holographic displays

By YongKeun Park, Jae-Hyeung Park, Hwi Kim, Hong-Seok Lee, Yoshio Hayasaki & Ting-Chung Poon

 Check for updates

Recollected by his colleagues as a creative and humble scholar with an indomitable will, ByoungHo Lee was enthusiastic about realizing the holistic potential of holographic displays.

ByoungHo Lee made major contributions in the fields of holographic display, holographic sensing and augmented and virtual reality technology until his untimely passing on 7 November 2022, aged 58.

Born in 1964 in Seoul, Korea, Lee possessed a limitless passion for learning. He was raised in a scholarly environment and was fascinated by the scientific cartoons and articles his father, an engineer, brought for him from his overseas trips. On deciding to pursue a career in photonics research, Lee obtained a bachelor's degree from the Department of Electrical Engineering, Seoul National University (SNU), and thereafter, received a doctoral degree from University of California, Berkeley, USA. He then assumed a professorship in the Department of Electrical Engineering in SNU. From then he devoted his life to conducting fundamental research in the field of photonics and display, which he believed was crucial for the progress of modern civilization and enhancing the quality of life. He investigated various business problems pertaining to the 'Dream Display' technology that best emulates the 3D view of natural scenery¹.

He and his team conducted several state-of-the-art studies in the field of optical information processing, fibre sensors, digital holography, nanophotonics, 3D displays, metasurfaces and augmented reality devices. Realization of 3D displays was one of Lee's ultimate research goals. Despite the early proof-of-principle demonstrations of 3D displays, their realization has been stymied by various technical challenges. Lee's research focused predominantly on 3D displays, specifically the holographic projection of light fields that can be perceived as a natural source of light by the naked eye. Throughout his research career, he presented extensive insights into holographic displays, defined their technical challenges and provided



ByoungHo Lee in 2021. Courtesy of Seoul National University.

pragmatic solutions for them². Holographic displays are typically characterized by a range of viewing angles and display sizes, which are limited by that of a spatial light modulator^{3,4}. Lee's team demonstrated a curved array of spatial light modulators for displaying dynamic holographic stereograms with a wide viewing angle⁵.

Recently, Lee discovered that thin metamaterials can effectively help to broaden the viewing angles of augmented reality devices. By utilizing a transparent metasurface, a compact near-eye display system was designed for augmented reality with a wide field of view⁶. Lee also harboured a vested interest in nanophotonics. In 2015, he and his colleagues presented the concept of cavity apertures, which can function as miniature dynamic colour pixels in display and sensing applications⁷. In exploiting the structure of a metal cavity and nanoaperture, they theorized that the colour and intensity of transmitted light can be simultaneously controlled, depending on the relative position of the nanoaperture in the cavity and the polarization state of the incident light.

Lee's contributions to research have gained global recognition. He co-authored more than 500 peer-reviewed scientific articles with a total citation count of 25,000 (on Google Scholar). He was the first and only engineer in South Korea to be awarded fellowships from

esteemed photonics and display organizations, such as SPIE, Optica (formerly OSA), IEEE and SID (the Society for Information Display). He received numerous awards, including the Presidential Young Scientist Award of Korea, Scientist of the Month Award of Korea, Jin-Bo-Jang's National Badge of Science of Korea, and the Sudang Award. Notably, he was also conferred with the title of Holoknight, the Knight of Holography, in 2014 by International Order of Holoknights for his distinguished contributions to holographic technology.

Lee was known to be humble and witty. He not only provided benevolent support to his colleagues but also encouraged young emerging scientists by offering them various research and collaboration opportunities. Lee was an innovative researcher with a vision, but at the same time a warm and caring teacher, mentor and good friend. He advised and inspired more than 100 PhD and Master's students, who are all actively working in and leading the display and photonics communities in academia and industry alike at the international level. He has also trained many scientists, advancing holography and display research and the industrial community.

He is survived by his wife and two daughters. He has passed early, but will be missed deeply for a long time.

YongKeun Park ^{1,2} , **Jae-Hyeung Park** ³, **Hwi Kim**⁴, **Hong-Seok Lee** ⁵, **Yoshio Hayasaki** ⁶ & **Ting-Chung Poon**⁷

¹Department of Physics, Korea Advanced Institute of Science and Technology (KAIST), Daejeon, Republic of Korea. ²Tomocube Inc., Daejeon, Republic of Korea. ³Department of Electrical and Computer Engineering, Inha University, Incheon, Republic of Korea. ⁴Department of Electronics and Information Engineering, Korea University, Sejong Campus, Sejong, Republic of Korea. ⁵Department of Electrical and Computer Engineering, Seoul National University, Seoul, Republic of Korea. ⁶Center for Optical Research and Education, Utsunomiya University, Utsunomiya, Japan. ⁷Bradley Department of Electrical and Computer Engineering, Virginia Tech, Blacksburg, VA, USA.

 e-mail: yk.park@kaist.ac.kr

Obituary

Published online: 19 January 2023

References

1. Lee, B. *Phys. Today* **66**, 36 (2013).
2. Hong, J. et al. *Appl. Opt.* **50**, H87–H115 (2011).

3. Yu, H., Lee, K., Park, J. & Park, Y. *Nat. Photon.* **11**, 186–192 (2017).
4. Poon, T.-C. *Digital Holography and Three-Dimensional Display: Principles and Applications* (Springer, 2006).
5. Hahn, J., Kim, H., Lim, Y., Park, G. & Lee, B. *Opt. Express* **16**, 12372–12386 (2008).

6. Lee, G.-Y. et al. *Nat. Commun.* **9**, 4562 (2018).
7. Yun, H., Lee, S.-Y., Hong, K., Yeom, J. & Lee, B. *Nat. Commun.* **6**, 7133 (2015).

Competing interests

The authors declare no competing interests.